We claim:

1. An apparatus, comprising:

a monolithic device, the monolithic device comprising;

a first CMOS imaging array; and

a dark current monitoring device integrated with the first CMOS imaging array, the dark current monitoring device monitoring the dark current during the time that the first CMOS imaging array is receiving an image.

2. The apparatus of claim 1, where the monolithic device consists of a single semiconductor chip comprising a silicon substrate with integrated circuitry integrated with a surface of the silicon substrate.

3. The apparatus of claim 1, where the monolithic device consists of a single semiconductor chip comprising a substrate with integrated circuitry integrated with a surface of the substrate comprising silicon germanium material.

4. The apparatus of claim 1, where the dark current monitoring device is at least one semiconductor light sensor integrated with the monolithic device having a means attached to the monolithic device to prevent light from activating the semiconductor light sensor.

5. The apparatus of claim 4, where multiple semiconductor light sensors are used to determine dark current variation over the monolithic device.

6. The apparatus of claim 4, where the at least one semiconductor light sensor is a second CMOS imaging array.

7. The apparatus of claim 6, where multiple CMOS imaging arrays are used to determine dark current variation over the monolithic device.

8. The apparatus of claim 1, where the dark current monitoring device comprises;

at least one temperature monitoring device for monitoring temperature of the monolithic device, and;

associated circuitry to determine dark current from the monitored temperature.

9. The apparatus of claim 8, where multiple temperature monitoring devices are used to determine dark current variation over the monolithic device.

10. The apparatus of claim 8, where the at least one temperature monitoring device is a PTAT circuit integrated with the monolithic device.

11. The apparatus of claim 8, where the at least one temperature monitoring device is a device monitoring the voltage drop across a P-N diode junction having a constant current.

12. The apparatus of claim 8, where the associated circuitry is integrated with the monolithic device to determine dark current from the monitored temperature

13. The apparatus of claim 1, further comprising;

a stored record of dark current from each pixel of the first CMOS image array, measured previous to the time that the first CMOS image array receiving the image;

associated circuitry using the stored record and the monitored dark current to correct the output of each pixel of the first CMOS image array.

14. The apparatus of claim 13, where the stored record and the associated circuitry using the stored record are integrated with the monolithic device.

15. A method of recording an image of an object using light reflected or transilluminated from the object, comprising;

forming an image of the object on a first CMOS image array by projecting the light reflected or transilluminated from the object on to the first CMOS image array, the first CMOS image array formed on a monolithic semiconductor substrate; and

monitoring the dark current of the first CMOS image array with at least one dark current monitoring device integrated with the first CMOS imaging array on the monolithic semiconductor substrate, the monitoring of the dark current concurrent with the forming of the image.

16. The method of claim 15, further comprising;
recording an output from the first monolithic CMOS image array; and
correcting the output from the first monolithic CMOS image array to account for the dark current monitored by the at least one dark current monitoring device.

17. The method of claim 16, wherein the step of correcting comprises;

recording (a) an output of the at least one dark current monitoring device and (b) the dark current output from each pixel of the unilluminated first CMOS image array in a different step than the step of forming the image;

calculating the dark current contribution at each pixel during the forming of the image on the basis of the dark current monitored concurrently with forming the image; and

subtracting the dark current contribution at each pixel from the output of the first monolithic CMOS image array.

18. The method of claim 16, wherein the step of correcting is performed by circuitry integrated on the monolithic semiconductor substrate.

19. The method of claim 15, wherein the step of monitoring the dark current comprises;
monitoring the temperature of the first monolithic CMOS imaging array with at least one temperature monitoring device integrated with the first monolithic CMOS imaging array; and
calculating the dark current from the monitored temperature.

20. The method of claim 19, wherein the step of monitoring temperature comprises;
monitoring the temperature at a plurality of locations on the monolithic semiconductor substrate; and
calculating the temperature variation over the first CMOS image array during the forming of the image.

21. The method of claim 15, wherein the step of monitoring the dark current comprises;
monitoring the dark current at a plurality of locations on the monolithic semiconductor substrate; and
calculating the variation of dark current over the first CMOS image array during the forming of an image of the object.

22. The method of claim 15, further comprising;

a) exposing the first CMOS image array for a time t_s, where t_s is a short enough time that dark current and projected light produce signals small compared to offset signals in pixels of the first CMOS array; and then

b) recording signals O_t measured as a result of exposure for time t_s; and then

c) subtracting O_t from signals produced by the first CMOS image array when exposure times are long enough that dark current signals are not small compared with O_t.

23. The method of claim 22, wherein the dark current signals of step c) are produced from an unilluminated first CMOS image array, and further comprising;

d) recording signals $S_d = G_t(f_t(T, t))$ which result from step c).

24. The method of claim 23, further comprising;

e) projecting light from a uniformly reflecting extended object on to the first CMOS array, the light intensity high enough that dark current signals are small compared to signals produced by the light illumination; and

f) recording signals $S_t = G_t(k_t I_t R_t QE_t) + O_t$ from the first CMOS array produced by light projected from the uniformly reflecting object; then

g) subtracting O_t from the results of step f);

h) recording an effective gain coefficient $G_t^* = G_t(k_t I_t QE_t)$.

25. The method of claim 24, wherein;

the step of forming an image of the object comprises recording signals

$S_t = G_t^* R_t + O_t + G_t f_t(T, t)$ from the first CMOS array; further comprising;

i) correcting the recorded values S_d to calculate $G_t f_t(T, t)$, wherein the results of the step of

monitoring the dark current are used to correct the recorded values S_d; and

j) calculating R_i from the known values of S_i, G_i*, O_i and G_i $f_i(T, t)$.

26. A system, comprising:

a monolithic device, the monolithic device comprising;

a first CMOS imaging array; and

a dark current monitoring device integrated with the first CMOS imaging array, the dark current monitoring device monitoring dark current concurrently with the recording of an image by the first CMOS imaging array;

an optical system for imaging light reflected or transilluminated from an object on to the first CMOS imaging array; and

circuitry for correcting the output from the first monolithic CMOS image array to account for the dark current monitored by the dark current monitoring device.

27. The system of claim 26, further comprising a storage device for storing the corrected output.

28. The system of claim 27, further comprising a display device for displaying the corrected output.

29. The system of claim 26, wherein the circuitry for correcting the output is integrated on the monolithic device.